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REV. 5-93US DEPARTMENT OF COMMERCE  
PATENT AND TRADEMARK OFFICEATTORNEYS DOCKET NUMBER  
**P00,1122****TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US)  
CONCERNING A FILING UNDER 35 U.S.C. 371**

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)

**09/623638**INTERNATIONAL APPLICATION NO.  
**PCT/DE99/00673**INTERNATIONAL FILING DATE  
**11 MARCH 1999**PRIORITY DATE CLAIMED  
**11 MARCH 1998**

TITLE OF INVENTION

**"ATM SWITCHING DEVICE WITH FIRST AND SECOND CONNECTION PATHS"**

APPLICANT(S) FOR DO/EO/US

**ARNO BRILL**

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay.
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of International Application as filed (35 U.S.C. 371(c)(2)) - drawings attached.
  - a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ has been transmitted by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2) - drawings attached.
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. §371(c)(3))
  - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ have been transmitted by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☒ have not been made and will not be made.
8. ☒ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98; (PTO 1449, Search Report, 2 References)
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included.  
(SEE ATTACHED ENVELOPE)
13. ☒ Amendment "A" Prior to Action.
  - ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☒ Change of Address of Applicants' Representative.
16. ☒ Other items or information:
  - a. ☒ Request for Approval of Drawing Modifications, 2 sheets of drawings, Figures 1-2.
  - b. ☒ Appointment of Associate Power of Attorney.
  - c. ☒ EXPRESS MAIL # EJ077700905US dated September 6, 2000.

ATTORNEY'S DOCKET NUMBER  
**P00 1122**

CALCULATIONS	PTO USE ONLY
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- a. ☒ A check in the amount of \$ 840.00 to cover the above fees is enclosed.
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A duplicate copy of this sheet is enclosed.
- c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 501519. A duplicate copy of this sheet is enclosed.

SEND ALL CORRESPONDENCE TO: Mark Berones

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534 Rec'd PCT/PTC 06 SEP 2000

BOX PCT  
IN THE UNITED STATES DESIGNATED/ELECTED OFFICE  
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE  
UNDER THE PATENT COOPERATION TREATY--CHAPTER II

10 Assistant Commissioner for Patents,  
Washington D.C. 20231

Sir:

**IN THE SPECIFICATION:**

replace lines 1-2 with

TITLE

## BACKGROUND OF THE INVENTION

in line 3, replace “for a communication network”, with --and related method for--;

cancel line 4;  
in line 5, cancel “switching equipment for”;  
above line 7, insert

--Description of the Related Art--;

- 5 in line 7, replace “equipments” with --equipment--;  
in line 14, cancel the second “the”;  
in line 16, cancel “this principle of the”;  
in line 19, replace “Bytes” with --bytes--;  
in line 22, cancel “(virtual path)”;
- 10 in line 24, replace “equipments provide” with --equipment provides--;  
in line 25, replace “allocate” with --allocates--;  
in line 27, replace “equipments” with --equipment--;  
in line 28, replace “have” with --has--, and replace “, but they” with --; it-
- ; and
- 15 in line 29, replace “know” with --knows--, and cancel “They are called”.

**On page 2:**

- in line 1, replace “virtual” with --Virtual--, and cancel “, since, in”;  
in line 2, replace “,” with --in that--;  
in line 4, after “i.e.”, insert --,--;
- 20 in line 10, cancel “what is referred to as”;  
in line 11, replace “therefor (virtual channel,” with --(--;  
in line 13, after “i.e.”, insert --,--, and replace “equipments, whereby”  
with --equipment by which--;
- in line 20, replace “As it has already been explained above, a” with --A--;
- 25 in line 22, replace “Thereby, only” with --Only--;  
in line 23, replace “equipments” with --equipment--, and after “channel”,  
insert --,--;
- in line 24, after “bandwidth”, insert --,--;
- in line 26, replace “It is configured in” with --In--; and

in line 27, after "equipment", insert --is configured--.

**On page 3:**

in line 1, before "assigning", insert --an--, and after "called", insert --a--;

in line 6, replace "by means of" with --via--, and replace "storing means"

5 with --storage--;

in line 7, after "as", insert --a--;

in line 9, cancel ",";

in line 10, cancel ",";

in line 14, after "as", insert --a--, and after "i.e.", insert --,--;

10 in line 15, replace "this" with --these--;

in line 17, replace "equipments" with --equipment units--;

in line 18, before "particularly", insert --e.g.,--;

in line 19, replace " , for example", with --)--;

in line 21, replace "equipments" with --equipment units--, and replace

15 "stem from" with --result from having--;

in line 22, replace "would be" with --isii--;

in line 25, cancel "subsequently", and replace "in greater" with --below  
in greater detail--;

in line 28, replace "equipments 1 - 3-, whereby" with --equipment units

20 1-3, by which--; and

in line 29, replace "to be considered" with --discussed--, and replace  
"equipments" with --equipment units--.

**On page 4:**

in line 6, after "i.e.", insert --,--;

25 in line 8, replace "storing means 5," with --storage 5--;

in line 9, replace "It is particularly fixed in the storing means 5" with --  
Particularly, the storage 5 stores--;

in line 10, replace "which" with --that--;

- in line 11, after “i.e.”, insert --,--;
- in line 13, replace “Let it be assumed in the” with --The--, and replace “case,” with --case assumes--;
- in line 16, replace “be” with --is--;
- 5 in line 18, after “i.e.”, insert --, it--, and after “as”, insert --an--;
- in line 19, after “configured”, insert --,--, and replace “storing means” with --storage--;
- in line 21, cancel “, regarding this,--;
- in line 25, replace “storing means” with --storage--, and replace
- 10 “represent” with --represents--;
- in line 26, after “i.e.”, insert --,--, and replace “storing means” with --storage--, and replace “store” with --stores--; and
- in line 29, after “as”, insert --an--.
- On page 5:**
- 15 in line 1, replace “. As it has already been explained,” with --,--;
- in line 2, replace “storing means 4 store” with --storage 4 stores--;
- in line 4, after “i.e.”, insert --,--;
- in line 5, replace “whereby” with --by which--;
- in line 6, replace “by means of” with --via--;
- 20 in line 9, replace “storing means” with --storage--;
- in line 14, cancel the last “,”;
- in line 15, before “for”, insert --(--;
- in line 16, before “,”, insert --)--;
- in line 20, replace “is initially to try” with --initially tries--;
- 25 in line 21, after “as”, insert --an--;
- in line 22, replace “and” with --, and tries--; and
- in line 23, replace “by means of” with --via--, and replace “storing means” with --storage--.

**On page 6:**

in line 17, replace “and” with --, but--;

in line 18, replace “equipments” with --equipment units--; and

in line 24, after “as”, insert --an--.

5

**On page 7:**

in line 2, replace --by means of-- with --via--;

in line 3, after “as”, insert --an--;

in line 7, replace “As it has already been explained, each” with --Each--;

in line 9, after “as”, insert --an--;

10

in line 19, after “as”, insert --the--;

in line 20, replace “by means of” with --via--;

in line 22, replace “equipments” with --equipment units--;

in line 25, replace “result” with --occur--; and

in line 27, replace “cannot efficiently be used as a result thereof.

15

Further” with --thus cannot be efficiently used. Furthermore--.

**On page 8:**

in line 1, replace the first “that” with --in which--;

in line 5, replace “, namely cleared down” with --(namely, cleared

20

down)--;

in line 8, after “as”, insert --a--;

above line 12, insert --SUMMARY OF THE INVENTION--;

replace lines 16-18 with

-- According to the present invention, this object is achieved by a switching  
25 equipment for a communication network and related method for using it, where  
the switching equipment comprises an adjacent switching equipment which is  
connected to the switching equipment via connecting paths, the connecting paths  
being divided into first connecting paths and second connecting paths, wherein,  
when a connection request is present, the switching equipment is only authorized

for the first connecting paths for allocating a transmission channel for the connection request, and the adjacent switching equipment that is connected to the first switching equipment via a corresponding second connecting path is authorized for allocating a corresponding transmission channel for the second connecting paths.

The switching equipment comprises a first storage for storing bits of information about the free or occupied resources of the first connecting paths; a controller detecting, on a basis of the bits of information stored in the first storing means, a suitable first connecting path which provides sufficient resources for a desired connection, when a connection request is present; and a second storage for storing bits of information about the free or occupied resources of the second connecting paths, the controller selecting one of the adjacent switching equipment on a basis of the bits of information stored in the second storage when a suitable first connecting path could not be detected on a basis of the bits of information stored in the first storage given a presence of a connection request, one of the adjacent switching equipment being connected to the switching equipment via one of the second connecting paths, which is more likely able to provide sufficient resources for the desired connection, and the controller transmitting an inquiry message to the selected adjacent switching equipment for allocating a transmission channel for the desired connection. —

in line 20, after “routing”, insert --;--;

in line 23, after “as”, insert --a--; and

in line 26, after “as”, insert --an--.

#### On page 9:

in line 1, replace “equipments” with --equipment units--;

in line 6, after “as”, insert --an--;

above line 11, insert --BRIEF DESCRIPTION OF THE DRAWINGS --;

in line 12, replace “. Shown are:” with --illustrated in the drawings.--;

in line 14, before “the”, insert --is a block diagram illustrating--;



in line 17, before "the", insert --is a block diagram illustrating--;  
above line 20, insert --DESCRIPTION OF THE PREFERRED  
EMBODIMENTS--;

cancel line 20;

5 in line 21, replace "reference to Figure 1, whereby" with --Figure 1  
shows--;

in line 22, cancel "are particularly represented";

in line 27, replace " , which is known per" with --similar to that in--; and  
replace line 28 with --Figure 2. However, the critical--.

10 **On page 10:**

in lin 4, after "as", insert --a--;

in line 8, replace "whereby" with --by which--;

in line 10, after "as", insert --an--;

in line 16, after "as", insert --a--;

15 in lines 17-18, replace "storing means" with --storage--;

in line 21, replace "means 4, which" with --4, where the--;

in line 22, after "as", insert --an--;

in line 25, replace "storage means" with --storage--; and

20 in line 29, replace "Further" with --Furthermore--, and replace "storing  
means" with --storage--.

**On page 11:**

in lines 1-2, replace "it is stored in the storage means 16" with --the  
storage 16 contains information stating--;

in line 2, replace "by means of" with --via--;

25 in line 9, cancel "it";

in line 10, after "as", insert --an--, and after "i.e.", insert --,--;

in line 13, after "as", insert --an--; and

in line 20, after "as", insert --an--.

**On page 12:**

in line 4, after “as”, insert --an--;

in line 6, after “an”, insert --appropriate--;

5 in line 7, replace “appropriate therefor, the control means” with --, the  
controller--;

in line 8, replace “access” with --accesses--, and replace “storing means”  
with --storage--;

in line 11, replace “control means 6 search” with --controller 6 searches”,  
and replace “storing means” with --storage--;

10 in lines 13-14, replace “Further, it can be additionally considered” with --  
Additionally,--;

in line 16, after “path”, insert --is considered--, and replace “storing  
means” with --storage--, and cancel “it”;

in line 24, replace “storing means” with --storage--;

15 in line 26, replace “storing means” with --storage--, and replace “.. Since  
merely” with --. Since--;

in line 27, replace “are” with --is--; and

in line 29, replace “thereof” with --of this--.

**On page 13:**

20 in line 10, replace “control means” with --controller--;

in line 11, replace “storing means” with --storage--;

in line 12, after “as”, insert --an--;

in line 14, cancel “thereof”;

in line 15, after “as”, insert --a--;

25 in line 16, replace “equipments” with --equipment units--;

in line 17, replace “control means access” with --controller accesses--;

in line 18, replace “storing means” with --storage--, and replace “detect”  
with --detects--;

in line 20, replace "As it has already been explained, merely" with --  
Only--;

in line 23, replace "storing means" with --storage--, and replace the last  
"case" with --situation--; and

5 in line 27, cancel "thereof".

**On page 14:**

in line 1, replace "merely" with --only--;

in line 3, replace "control means" with --controller--, and replace  
"recognize" with --recognizes--;

10 in line 5, replace "select" with --selects--, and after "as", insert --an--;

in line 10, replace "by means of" with --via--;

in line 12, replace "for [...] it" with --,-- and after "as", insert --an--;

in line 19, replace "by means of" with --via--;

in line 21, after "i.e.", insert --,--;

15 in line 22, replace "by means of" with --via--;

in line 23, replace "by means of" with --via--;

in line 26, replace "control means" with --controller--; and

in line 27, replace "control means" with --controller--.

**On page 15:**

20 in line 6, after "as", insert --an--, and after "i.e.", insert --,--;

in line 9, cancel "it should be pointed out that,--";

in line 10, after "as", insert --a--;

in lines 11-12, replace "storing means" with --storage--;

25 in line 13, replace "Exclusively the" with --The--, and after "as", insert --  
an--;

in line 14, after "to", insert --exclusively--; and

below line 15, insert

-- The above-described switching equipment and related method are  
illustrative of the principles of the present invention. Numerous modifications

and adaptations thereof will be readily apparent to those skilled in this art without departing from the spirit and scope of the present invention.--.

**On page 16:**

cancel lines 1-8.

5     **IN THE CLAIMS:**

On page 17, at line 1, replace "Patent Claims" with --WE CLAIM AS OUR INVENTION--.

Please amend claims 1-8 as follows:

1.     (Amended) Switching equipment [(1)] for a communication network,  
10     said communication network comprising:  
          an adjacent switching equipment which is connected to said [whereby  
the] switching equipment [(1) is connected] via [at least one] connecting paths  
[path (9 - 15) to at least one other adjacent switching equipment (2, 3) of the  
communication network, and],  
15     said [whereby the] connecting paths [(9, 15) connected to the switching  
equipment (1) are] being divided into first [(9 - 11)] connecting paths and second  
[(12 - 15)] connecting paths, wherein [whereby], when a connection request is  
present, said [the] switching equipment [(1)] is only authorized for said [the] first  
connecting paths [(9 - 11)] for allocating a transmission channel for said [this]  
20     connection request, and said [whereas the] adjacent switching equipment [(2, 3)]  
that is connected to said [the] first switching equipment [(1)] via a [the]  
corresponding second connecting path is authorized for allocating a corresponding  
transmission channel for said [the] second connecting paths [(12 - 15)],  
said switching equipment comprising:  
25     a [with] first storage [storing means (4)] for [purposes of] storing bits of  
information about said [the] free or occupied resources of said [the] first  
connecting paths [(9 - 11), and];

a controller detecting [with control means (6) in order to], on a [the] basis of said [the] bits of information stored in said [the] first storing means [(4)], [detect] a suitable first connecting path [(9 - 11)], which provides sufficient resources for a [the] desired connection, when a connection request is present; and [ , characterized in that]

a second storage [storing means (16) are present] for [purposes of] storing bits of information about said [the] free or occupied resources of said [the] second connecting paths [(12 - 15)], [and that]

said controller selecting [the control means (6) are fashioned such that they select an] one of said adjacent switching equipment [(2, 3)] on a [the] basis of said [the] bits of information stored in said [the] second storage [storing means (16)] when a suitable first connecting path [(9 - 11)] could not be detected on a [the] basis of said [the] bits of information stored in said [the] first storage [storing means (4)] given a presence of a connection request,

said one of the adjacent [which] switching equipment [(2, 3) is] being connected to said [the] switching equipment [(1)] via one of said [a] second connecting paths [path (12 - 15)], which is more likely able to provide [probably provides] sufficient resources for said [the] desired connection, and

said controller transmitting [such that they transmit] an inquiry message to said [the] selected adjacent switching equipment [(2, 3)] for [purposes of] allocating a transmission channel for said [the] desired connection.

2. (Amended) Switching equipment according to claim 1, wherein [characterized in that,] said controller is [the control means (6) are] fashioned such that it [they], subsequent to said [the] detection of a suitable first connecting path [(9 - 11)], transmits [transmit] bits of information about an [the] allocated transmission channel for said [the] desired connection and bits of information about said [the] detected connecting path [(9- 11)] to said [the] adjacent switching equipment [(2, 3)], which is connected to said [the] first switching equipment [(1)] via said [the] detected first connecting path [(9 - 11)].

3. (Amended) Switching equipment according to claim 2, wherein [characterized in that] said controller is [the control means (6) are] fashioned such that it [they], when a first connecting path [(9- 11)] with resources that are sufficient for said [the] connection request could not be detected, transmits said [transmit the] inquiry message for allocating a transmission channel for said [the] desired connection to said [the] adjacent switching equipment [(2, 3)] in [the form of] a forward message without bits of information about said [the] connecting path or said [the] transmission channel.

4. (Amended) Switching equipment according to claim 1, wherein [one of the previous claims, characterized in that] said controller is [the control means (6) are] fashioned such that it [they], subsequent to said [the] inquiry message to said [the] adjacent switching equipment [equipments (2, 3)] selected by said controller [the control means (6)] and subsequent to said [the] allocation of a transmission channel via [by means of] said [the] adjacent switching equipment [(2, 3), renew] renews said [the] bits of information, which are stored in said [the] second storage [storing means (6)], on a [the] basis of a confirmation message of said [the] adjacent switching equipment [(2, 3)], whereby said [the] confirmation message comprises [comprise] bits of information about said [the] transmission channel allocated by said [the] adjacent switching equipment [(2, 3)], about [the] resources occupied for said [the] desired connection and about said [the] second connecting path [(12 - 15)] selected via [by means of] said [the] adjacent switching equipment [(2, 3)].

5. (Amended) Switching equipment according to claim 1, wherein [one of the previous claims, characterized in that] said [the] communication between said [the] switching equipment [(1)] and said [the] adjacent [further] switching equipment [equipments (2, 3) of the communication network] ensues via B-ISUP signalization messages.

6. (Amended) Switching equipment according to claim 1, further comprising: [one of the previous claims, characterized in that]

a third storage [storing means (5) are provided] for [purposes of] storing configuration data of said [the] switching equipment [(1)], [whereby] wherein said [the] configuration data prescribe, regarding said [the] switching equipment [(1)], which of said [the] connecting paths connected to said [the] switching equipment [(1)] are first connecting paths [(9 - 11)], for which said [the] switching equipment [(1)] is authorized for allocating a transmission channel when a connection request is present, and which of said [the] connecting paths are second connecting paths [(12 - 15)], for which said [the] switching equipment [(1)] is not authorized, but for which a corresponding said [correspondingly] adjacent switching equipment [(2, 3)] is authorized for allocating a transmission channel for said [the] connection request.

7. (Amended) Switching equipment according to claim 6, wherein [characterized in that] said [the] configuration data stored in said [the] third storage [storing means (5)] prescribe to which said adjacent switching equipment [(2, 3)] said [the] switching equipment [(1)] is to detect a connecting path when a connection request is present.

8. (Amended) Switching equipment according to claim 1, wherein said communication network is [Utilization of a switching equipment according to one of the previous claims in] an ATM broadband communication network.

Please add the following claims 9-16.

9. A method for using switching equipment in a communication network, said communication network comprising said switching equipment, adjacent switching equipment and connecting paths, said connecting paths connecting said switching equipment to said adjacent switching equipment,

said connecting paths comprising first connecting paths and second connecting paths,

said switching equipment comprising a controller, a first storage, and a second storage,

5 said method comprising the steps of:

authorizing, by said switching equipment, an allocation of a transmission channel in response to a connection request only for said first connecting paths;

10 authorizing, by said adjacent switching equipment, an allocation of a transmission channel in response to a connection request only for said second connecting paths;

storing, by said first storage, bits of information about free or occupied resources of said first connecting paths;

15 detecting, by said controller, a suitable first connecting path based on said bits of information stored in said first storage which provides for desired connections, when a connection request for a desired connection is present;

storing, by said second storage, bits of information about free or occupied resources of said second connecting paths;

when a suitable first connecting path could not be detected in said step of detecting a suitable first connecting path,

20 selecting, by said controller, an adjacent switching equipment on a basis of said bits of information stored in said second storage when a suitable first connecting path could not be detected in said step of detecting a suitable first connecting path;

25 transmitting, by said controller, an inquiry message to said selected adjacent switching equipment for allocating a transmission channel for said desired connection requested by said connection request; and

allocating a transmission channel for said desired connection.



10. The method according to claim 9, further comprising the step of:  
transmitting, by said controller subsequent to said step of detecting a  
suitable first connecting path, bits of information about said allocated  
transmission channel and bits of information about said detected first connecting  
5 path;

11. The method according to claim 10, wherein said inquiry message  
transmitted in said step of transmitting the inquiry message is transmitted as a  
forward message without bits of information about said connecting paths or said  
transmission channel.

10 12. The method according to claim 9, further comprising the step of:  
renewing said bits of information stored in said second storage, by said  
controller subsequent to said step of transmitting an inquiry message and  
subsequent to said step of allocating a transmission channel, based on a  
confirmation message of said adjacent switching equipment, said confirmation  
15 message comprising bits of information about said transmission channel allocated  
by said adjacent switching equipment, about resources occupied for said desired  
connection, and about said second connecting path selected by said adjacent  
switching equipment.

13. The method according to claim 9, wherein communication between said  
20 switching equipment and said adjacent switching equipment ensues via B-ISUP  
signalization messages.

14. The method according to claim 9, wherein said switching equipment  
further comprises a third storage, said method further comprising the step of:  
storing configuration data of said switching equipment by said third  
25 storage, wherein said configuration data comprise information about which of said  
connecting paths connected to said switching equipment are first connecting paths

for which said switching equipment is authorized for allocating a transmission channel when a connection request is present, and which of said connecting paths are second connecting paths for which said switching equipment is not authorized, but for which an adjacent switching equipment is authorized for allocating a transmission channel for said connection request.

15. The method according to claim 14 wherein said configuration data further comprises information about which adjacent switching equipment said switching equipment is to detect a connection path when a connection request is present.

16. The method according to claim 9, wherein said communication network is an ATM broadband communication network.

#### **IN THE ABSTRACT:**

##### **On page 20:**

cancel line 3;

in line 5, after "equipment", insert "is provided", and replace "whereby" with --by which--;

in line 7, replace "equipments" with --equipment units--;

in line 12, replace "storage means" with --storage--;

in line 13, replace "equipments" with --equipment units--;

in line 16, replace "storing means" with --storage--; and  
cancel line 20.

#### **REMARKS**

The present Amendment revises the specification and claims to conform to United States patent practice, before examination of the present PCT application in the United States National Examination Phase. All of the changes are editorial and applicant believes no new matter is added thereby. The

amendment of claims 1-8 and the addition of claims 9-16 is not intended to be a  
surrender of any of the subject matter of those claims.

Early examination on the merits is respectfully requested.

Submitted by,

5

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Attorneys for Applicant

10

Siemens AG  
New PCT application  
Our Case P-00,1122  
GR 98 P 1313 P US  
Inventor: Brill

Translation / August 1, 2000 / 1262 / 5940 words

**SWITCHING EQUIPMENT**

The present invention relates to a switching equipment for a communication network according to the preamble of claim 1. In particular, the present invention relates to a switching equipment for an ATM broadband communication network.

In communication networks, a plurality of switching equipments, which serve as network nodes, are physically connected to one another via connecting paths. For purposes of setting up a connection between two users of the communication network, an appropriate connecting path, proceeding from the destination node, must be initially determined from the calling user to the called user.

In order to facilitate the determination of the appropriate connecting path (routing), the principle of the virtual connections has been invented, which is particularly applied in ATM broadband communication networks (asynchronous transfer mode). The transport of the data via the network is facilitated with the aid of this principle of the virtual connections and therefore is accelerated. According to the ATM standard, the data to be transmitted are transmitted in the form of cells, which generally comprise a control field (header) of 5 bytes and an information field (payload) of 48 Bytes. The sent ATM cells, corresponding to the bits of information prescribed in their headers, are passed through the communication network on "virtual paths" or "virtual connections" (virtual path). According to the principle of the virtual connections, the path to the destination is prescribed only once at the beginning. The individual switching equipments provide this desired switching path with a code that is valid respectively between two adjacent network nodes and allocate the code to the connection. This code is respectively noted in the control field (header) of the cells (virtual path connection identifier, VPCI). Therefore, the switching equipments no longer have to prepare the destination path anew when an ATM cell arrives, but they merely look at the code and thus know the desired destination. They are called

- "virtual connections", since, in contrast to real connections in the communication network, the transmission channel is not permanently busy for the duration of the connection, but the transmission channel is occupied only when data to be transmitted are actually present, i.e. that packets or cells of a connection are not transmitted without pauses during the entire connection time, but packets of other connections are forwarded in the pauses on the same transmission path at the same time.

- What derives from the previously explained principle of the virtual connections is that a plurality of transmission channels are transmitted via a virtual connection (virtual path connection, VPC). Each transmission receives a what is referred to as virtual channel therefor (virtual channel, VC), so that a virtual path can comprise a plurality of virtual channels. The allocation of the virtual channels ensues in the network nodes, i.e. the individual switching equipments, whereby, when a virtual channel is allocated or, respectively occupied, the resource (bandwidth) required for the respective transmission of the virtual channel must be occupied at the same time. The basic method for the occupancy of a virtual channel and therefore of the bandwidth for the respective connection is, according to the ITU-T recommendation Q.2764 (International Telecommunications Union), defined as follows:

- As it has already been explained above, a virtual channel is prescribed between two adjacent network nodes or, respectively, switching equipments when the appropriate transmission path or, respectively, connecting path is prescribed. Thereby, only one of the two adjacent switching equipments is allowed to assign the virtual channel and therefore the occupied bandwidth in order to avoid a counter-occupancy of transmission channels and also in order to exclude a counter-occupancy of the bandwidth for the individual transmissions. It is configured in each switching equipment which of the connected connecting paths the respective switching equipment is allowed to assign a virtual channel and therefore a bandwidth to be occupied. The switching equipment authorized for allocating a virtual channel is called

"assigning exchange", whereas the other switching equipment, in this case, is called "non-assigning exchange". Each switching equipment monitors or, respectively, keeps track of the free or, respectively, occupied bandwidth of exclusively the virtual connections for which the switching equipment is configured as "assigning exchange".

- 5 The administration of the free or, respectively, occupied bandwidth ensues in the form of a table, which is realized by means of a file or another storing means, and which is referred to as "bandwidth pool".

- 10 A switching equipment, which is configured as a "non-assigning exchange" for a specific virtual connection, is not allowed to occupy a virtual channel for this virtual connection and therefore is not allowed to occupy a bandwidth for a connection request either. Particularly according to the prior art, a switching equipment is not to keep track of the free or, respectively, occupied bandwidth of virtual connections, for which it is configured as "non-assigning exchange", i.e. that a "bandwidth pool" is not
- 15 to be kept in the corresponding switching equipment regarding this virtual connections, since the "bandwidth pools" that are simultaneously kept in the two switching equipments would otherwise never be identical in the course of the switching traffic (particularly during the connection setup between the B-ISUP- messages "release message" (REL) and "release complete" (RLC), for example. Besides, the "bandwidth
- 20 pools" would otherwise diverge due to different calculation algorithms in the two switching equipments, which can stem from different manufacturers or network providers; this would be particularly serious when the bit rates are not constant.

- 25 The switching method, which has previously been proposed according to the ITU-T- recommendation Q.2764, is subsequently explained in greater on the basis of Figure 2.

- Figure 2 exemplary shows the section of a communication network with three switching equipments 1 - 3, whereby, in the present case, the switching equipment 1 is to be considered in greater detail. The individual switching equipments 1 - 3 are
- 30 connected to one another respectively via a plurality of virtual connecting paths

(virtual path connection, VPC) 8 - 15. The switching equipment 1 comprises a central control device 6, which is responsible for processing incoming connection requests and for the corresponding connection setup to the other switching equipments 2 and 3. In particular, when a connection request is present, the control device 6 selects a suitable

5 connecting path to an adjacent switching device 2, 3 and occupies - if possible - the bandwidth required for the connection request, i.e. that it allocates a virtual transmission channel to an adjacent switching device 2, 3. The switching equipment 1 comprises storing means 5, in which the function of the switching equipment 1 is configured. It is particularly fixed in the storing means 5 for which of the connecting

10 paths 9 - 15, which are connected to the switching equipment 1, the switching equipment 1 can become active, i.e. for which of the connected connecting paths 9 - 15 the switching equipment 1 itself is allowed to allocate a virtual channel and therefore is allowed to assign bandwidths. Let it be assumed, in the present case, that the switching equipment 1 is allocation-authorized for the connecting paths 9 - 11 and

15 therefore is allowed to give the required bandwidth when a connection request is present. On the other hand, the switching equipment 2 be allocation-authorized for the connecting paths 12, 13, whereas the switching equipment 3 is allocation-authorized for the connecting paths 14, 15, i.e. is presupposed as "assigning exchange". For example, it is also configured in the storing means 5, via which of the adjacent network

20 nodes a connecting path is generally to be set up when a connection request is present. For example, it can be fixed, regarding this, that the switching equipment 1 always selects a connecting path via the switching equipment 2 when a connection request is present.

25 The switching equipment 1 also comprises storing means 4, which represent the previously described "bandwidth pool", i.e. that the storing means 4 store a table in which the free or, respectively, occupied bandwidth of all connecting paths connected to the switching equipment 1 is administered, for which bandwidth the switching equipment 1 is allocation-allocation-authorized and becomes active as "assigning



exchange". As it has already been explained, this is merely the case for the connecting paths 9 - 11 in the present case. As shown in Figure 2, the storing means 4 store the respectively occupied resources for each adjacent destination node 2, 3 and for each allocation-authorized connecting path 9 - 11, i.e. that they store the respectively

- 5 occupied bandwidth, whereby each connecting path (virtual path connection, VPC) is identified by means of a corresponding identifier (virtual path connection identifier, VPCI). Each virtual connecting path can comprise a plurality of virtual channels that have been allocated by the switching equipment 1 to this connecting path, so that the table (bandwidth pool) stored in the storing means 4 considers the virtual channels
- 10 allocated for each connecting path with the aid of an identifier (virtual channel identifier, VCI) and considers the bandwidth that is respectively occupied for the corresponding virtual channel.

- When a connection request is present, which is supplied to the switching equipment 1,
- 15 for example, via a further connecting path bundle 7 of a further (not shown) adjacent switching equipment, a suitable connecting path and a suitable transmission channel are fixed as follows:

- As soon as the switching equipment 1 receives a connection request, the switching
- 20 equipment 1 is initially to try to occupy a connecting path, for which the switching equipment 1 is configured as "assigning exchange", with an appropriate transmission channel and to assign the bandwidth required for the connection request. This ensues by means of evaluating the table deposited in the storing means 4. For example, when a connection request is present that would occupy approximately 40 % of the
- 25 bandwidth available in total on the connecting path 9, the switching equipment 1 could select the connecting path 9 for the desired connection and could allocate a virtual channel VCI-C and assign the bandwidth given the situation shown in Figure 2. The transmission of control messages between the individual switching equipments 1 - 3 ensues according to the B-ISUP signaling protocol, so that the switching

equipment 1, subsequent to the allocation of a virtual channel, informs the switching equipment 2 about the selected connecting path and the allocated transmission channel (potentially the occupied bandwidth) in the form of corresponding identifiers (virtual path connection identifier, VPCI and virtual channel identifier, VCI), whereby this  
 5 ensues in the form of the first B-ISUP-forward message (initial address message, IAM).

On the other hand, when the switching equipment 1 was not able to detect a suitable transmission channel in the connection paths 9 - 11 for which it is configured as  
 10 "assigning exchange", the connection must ensue via one of the connecting paths 12 - 15, for which the switching equipment 1 is configured as "non-assigning exchange". In this case, the switching equipment 1 is not allowed to allocate a transmission channel and is not allowed to assign bandwidth for the desired connection, but must inquire the adjacent switching equipment 2, 3 about the required bandwidth. For this purpose, the  
 15 switching equipment acting as "non-assigning exchange" does not insert identifiers into the B-ISUP-forward message IAM via the selected connecting path and the allocated transmission channel (VPCI, VCI) and sends this B-ISUP-forward message to one of the adjacent switching equipments 2, 3. This ensues without the switching equipment 1 having bits of information about whether the bandwidth required for the  
 20 desired connection can be provided by the corresponding switching equipment at all. After receipt of the requests for the allocation of a transmission channel, the corresponding switching equipment 2, 3, if possible, allocates a transmission channel on one of the connecting paths, for which the corresponding switching equipment is configured as "assigning exchange", to the desired connection. For example, when the  
 25 switching equipment 1 has transmitted a request for allocating a transmission channel to the switching equipment 2, the switching equipment 2 can search for an appropriate transmission channel merely on the connecting paths 12 and 13. When the switching equipment 2, in this case, is able to allocate an appropriate transmission channel on the connecting paths 12 and 13, the switching equipment 1 is informed of the selected

connecting path and of the selected transmission channel in the form of the identifiers VPCI, VCI by means of the switching equipment 2 in a corresponding first B-ISUP-return-message, which is referred to as "initial address message" (IAM).

- 5 The following problems result from the previously described course of action:

As it has already been explained, each switching equipment 1 merely has bits of information about the bandwidth available on the connecting paths for which the respective switching equipment has been configured as "assigning exchange", namely

10 for which the respective switching equipment is authorized for allocating a transmission channel and for occupying corresponding bandwidth. For example, when the switching equipment 1, in Figure 2, is not able to find an appropriate connecting path among these connecting paths for a present connection request, the occupancy message, namely the request regarding the occupancy of a transmission channel, is

15 simply sent to the first best adjacent switching equipment 2, 3. This ensues without knowing whether the respective adjacent switching equipment 2, 3 provides sufficient resources for the desired connection. When the adjacent switching equipment 2, 3 contacted by the switching equipment 1 is not able to provide the required bandwidth on the connecting paths for which the switching equipment 2, 3 is configured as

20 "assigning exchange", the connection request is rejected by means of a B-ISUP-return-message IAR (initial address reject). In this case, the switching equipment 1 tries again and inquires another one of the adjacent switching equipments 2, 3 about whether it can provide a suitable connecting path for the desired connection (re-routing). Generally, the number of these re-routing processes is limited to one trial, so that a re-

25 routing via a third connecting path can basically not result. However, the resources on the connecting paths, for which the switching equipment 1 is configured as "non-assigning exchange", cannot efficiently be used as a result thereof. Further, what derives from the previously described course of action is that the likelihood of a successful connection setup due to the fact that the switching equipment 1, for the case

that it itself cannot detect a suitable connecting path, is reduced and that a 'blind traffic' can occur. However, when a suitable connecting path between the switching equipment 1 and an adjacent switching equipment 2, 3 is not found, all connecting paths that have already been set up before the switching equipment 1, would have to  
 5 be retroactively released, namely cleared down; this is extremely complex.

Finally, it also derives from the previously cited reasons that a switching equipment should not be configured as "non-assigning exchange" for all connecting paths present between two switching equipments, since this would be extremely inefficient for a  
 10 successful connection setup.

Therefore, the present invention is based on the object of fashioning a switching equipment of the species cited above such that the likelihood of a successful connection setup and the efficiency of the connection setup is increased.

15 According to the present invention, this object is achieved by means of the features cited in claim 1. The subclaims describe advantageous and preferred exemplary embodiments of the present invention.

20 According to the present invention, the connection path search, namely the "routing" is fashioned significantly more efficient in that the switching equipment also keeps bits of information about the momentary occupancy of the connecting paths for the connecting paths, for which it is configured as "non-assigning exchange". In particular, these bits of information are deposited in the form of a data shadow table  
 25 ("shadow bandwidth pool"). When the switching equipment is not able to detect a suitable connecting path among the connecting paths for which it itself is configured as "assigning exchange", the switching equipment, on the basis of the bits of information stored in this shadow table, can select an adjacent switching equipment that provides, with great probability, sufficient resources for the connection request. Adjacent

switching equipments that are likely not to be able to provide the required bandwidth are not taken into consideration for the "routing process" at all.

As a result of this embodiment of the present invention, the number of the successful  
5 connection trials can be significantly increased in the case that the switching equipment cannot detect any suitable connecting paths, for which it itself is configured as "assigning exchange". The blind traffic, which is conditioned by hopeless connection setups, is significantly reduced and the efficiency of the path search is considerably increased.

10 The invention is subsequently explained in greater detail on the basis of a preferred embodiment. Shown are:

Figure 1 the exemplary construction of a preferred embodiment of a switching  
15 equipment according to the present invention, and

Figure 2 the exemplary construction of a known switching equipment for an ATM  
communication network.

20 The invention is subsequently explained on the basis of a preferred embodiment upon reference to Figure 1, whereby the differences of the present invention vis-a-vis the known switching equipment shown in Figure 2 are particularly represented. The switching equipment shown in Figure 1 is based on the switching equipment shown in Figure 2, so that the previously described way of functioning of the known switching  
25 equipment is expressly referenced here.

The switching equipment 1 shown in Figure 1 functions in a way, which is known per se, as it has previously been explained on the basis of Figure 2. However, the critical difference of the present invention vis-a-vis the known switching equipment is the fact

that, according to the present invention, the switching equipment 1 also stores bits of information about the occupancy of the connecting paths that are connected to the switching equipment 1, for which connecting paths the switching equipment 1 is configured as "non-assigning exchange", namely for which the switching equipment 1 is not authorized for the allocation of a transmission channel (virtual channel, VC) and for the corresponding occupancy of the bandwidth when a connection request is present. Given the exemplary embodiment shown in Figure 1, this is particularly the case with respect to the connecting paths 12 - 15, whereby the switching equipment 2 is configured as "assigning exchange" concerning the connecting paths 12, 13 and the switching equipment 3 is configured as "assigning exchange" concerning the connecting paths 14, 15, and only the switching equipment 2 or, respectively, 3 is allowed to allocate a transmission channel and a corresponding bandwidth when a connection request is present about these connecting paths 12 - 15.

The switching equipment 1 administers the bits of information about the occupied resources of the respective connecting paths, for which it is configured as "non-assigning exchange", in the form of a shadow table that is deposited in further storing means 16. This shadow table can be particularly realized in the form of a file or in the form of a physical storage unit. This shadow table ("shadow bandwidth pool") is essentially analogously structured to the table ("bandwidth pool") deposited in the storage means 4, which table administers the connecting paths 9 - 11, for which the switching equipment 1 is configured as "assigning exchange". This means that the momentary occupancy of the individual connecting paths 12 - 16 and the virtual channels ("virtual channel, VC) momentarily allocated via these connecting paths are also defined in this table, which is deposited in the storing means 16. Each connecting path is identified in the form of an identifier ("virtual path connection identifier, VPCI), and the transmission channels that are momentarily fixed via this connecting path are specified in the form of "virtual channel identifiers, VCI" for each connecting path. Further, the table deposited in the storing means 16 contains how many resources are

momentarily occupied by the respective connection. For example, it is stored in the storing means 16 that the transmission, which is specified by means of the identifier VCI - C, momentarily occupies 80 % of the bandwidth available via the connecting path 12 (VPCI = 12). Corresponding bits of information are kept for all other

- 5 connecting paths 12 - 15, for which the switching equipment 1 is not authorized for the allocation of a transmission channel and for the occupancy of bandwidth.

For example, when the switching equipment 1 receives a connection request via the connecting path bundle 7, the switching equipment 1 initially tries - as it has already  
10 been explained on the basis of Figure 2 - to act as "assigning exchange", i.e. that the switching equipment 1 tries to occupy a suitable transmission channel and a corresponding bandwidth in the connecting paths, for which the switching equipment 1 is configured as "assigning exchange". In the present exemplary embodiment, this is the case regarding the connecting paths 9 - 11. When a suitable connecting path,  
15 which provides sufficient resources for the desired connection, has been detected by the switching equipment 1 from the connecting paths 9 - 11, the switching equipment 1 allocates a transmission channel to the desired connection on the detected connecting path and occupies the required bandwidth. The switching equipment 1 subsequently informs the corresponding adjacent switching equipment 2 or 3, in the form of the first  
20 B-ISUP-forward message, namely in the form of the what is referred to as IAM-message ("initial address message"), of the "virtual path connection identifier" (VPCI) and the "virtual channel identifier" (VCI) of the occupied channel. To that extent, the function of the inventive switching equipment shown in Figure 1 corresponds to the function of the switching equipment that is already known (compare Figure 2).

25

However, when the switching equipment 1, on the basis of the connecting paths 9 - 11 for which the switching equipment 1 is authorized for the allocation of a transmission channel and for the occupancy of bandwidth, is not able to detect a suitable connecting path that provides sufficient resources for the desired connection, the switching

equipment 1 must act as "non-assigning exchange" and must inquire one of the adjacent switching equipments 2, 3 about the required bandwidth. This means that the switching equipment 1 must detect a suitable adjacent switching equipment 2, 3 that acts as "assigning exchange" for one of the connecting paths connected to the

5 switching equipment 1. In the exemplary embodiment shown in Figure 1, this is particularly the case with respect to the connecting paths 12 - 15. In order to detect an adjacent switching equipment 2, 3 appropriate therefor, the control means 6 of the switching equipment 1 access the bits of information deposited in the storing means 16, namely access the shadow table (shadow bandwidth pool).

10 The control means 6 search the bits of information deposited in the storing means 16 for an adjacent switching equipment 2, 3 that is highly likely to be able to provide the bandwidth required for the present connection request. Further, it can be additionally considered, for purposes of detecting the adjacent switching equipment to be

15 contacted, which of the adjacent switching equipments 2, 3 offers the shortest connecting path. This default is normally deposited in the storing means 5, since - as it has already been explained on the basis of Figure 2 - it is configured, already at the beginning of the initial operation, via which adjacent switching equipment a connection setup should normally ensue.

20 Let it be initially assumed, in the present case, that a connection request, which would occupy approximately 20 % of the resources available in total on one of the connecting paths 9 - 15, is present at the switching equipment 1. Given the situation shown in Figure 1 and the table content of the storing means 4 and 16 shown in Figure 1, this

25 would mean that the switching equipment 1 initially searches the table content (bandwidth pool) of the storing means 4 for an appropriate connecting path.. Since merely a total of 70 % of the connecting path 9 are momentarily occupied by the transmission channels VCI-A and VCI-B, the connecting path 9 still provides sufficient resources, namely a sufficient bandwidth, for the desired connection request. As a result thereof,



the switching equipment 1 can select the connecting path 9 as suitable connecting path for the desired connection and, for example, allocates the transmission channel with the "virtual channel identifier" VCI-G to the desired connection. The switching equipment 2 is subsequently informed of the bits of information VPCI=9 and

5 VCI=VCI-G in the form of the first B-ISUP-forward message.

Subsequently, let it be assumed that the connection request at the switching equipment would occupy, for example, 50 % of the bandwidth respectively available in total on the individual connecting paths 9 - 15. In this case, the switching equipment 1 or, respectively, its control means 6, on the basis of the bits of information deposited in the storing means 6, cannot detect a suitable connecting path to an adjacent switching equipment 2, 3, for which the switching equipment 1 has been configured as "assigning exchange", namely for which the switching equipment 1 is authorized for providing a transmission channel and for occupying bandwidth. As a result thereof, the switching equipment 1 must act as "non-assigning exchange" and must inquire one of the adjacent switching equipments 2, 3 about bandwidth. In order to select a suitable switching equipment, the control means access the bits of information deposited in the storing means 16 (shadow bandwidth pool) and detect an adjacent switching equipment 2, 3 that is highly likely to provide sufficient resources for the present connection setup. As it has already been explained, merely the connecting paths of the switching equipment 1, regarding which connecting paths the switching equipment 1 is not authorized for allocating a transmission channel and for occupying bandwidth, are considered in the storing means 16. In the present case, this is particularly the case with respect to the connecting paths 12 - 15. According to Figure 1, it is stored, for example, that 2 transmission channels VCI-C and VCI-D, which occupy a total of 90 % of the resources available on the connecting path 12, have already been allocated by the switching equipment 2 for the connecting path 12. As a result thereof, the connecting path 12 cannot be taken into consideration for the present connection request. On the other hand, two transmission channels VCI-E and VCI-F, which

momentarily merely occupy 30 % of the resources available on this connecting path, have been allocated by the switching equipment 2 on the connecting path 13. The control means 6 therefore recognize that the switching equipment 2 is likely to provides sufficient resources (namely in the form of the connecting path 13) for the pending connection request and therefore select the switching equipment 2 as "assigning exchange" for the present connection request. Subsequently, the switching equipment 1 transmits the B-ISUP-forward message IAM ("initial address message") to the switching equipment 2, however, without transmitting an appropriate VPCI information or VCI information at the same time. This occupancy message IAM is subsequently evaluated by means of the switching equipment 2, and the switching equipment 2 checks, on the basis of the bits of information available to it about the connecting paths 12, 13 for [...] it is configured as "assigning exchange", whether a connecting path is, in fact, available that provides sufficient capacities or, respectively, resources for the present connection request. When this is the case, the switching equipment 2 allocates a transmission channel on a suitable connecting path to the present connection request. In the present case, the switching equipment 2, for example, can allocate a transmission channel VCI-G on the connecting path 13. The switching equipment 1, in the form of the first B-ISUP-return message IAA ("initial address acknowledgment"), is subsequently informed by means of the switching equipment 2 regarding bits of information about the selected connecting path and the allocated transmission channel, i.e. that the switching equipment 1 is informed of the values VPCI=13 and VCI=VCI-G by means of the switching equipment 2. The bits of information transmitted by means of the switching equipment 2 to the switching equipment 1 also contain bits of information about the resources occupied by the selected transmission channel, so that the switching equipment 1 or, respectively, its control means 6 can correspondingly update the bits of information deposited in the control means 6.

Should the switching equipment 2, contrary to the assumption of the switching equipment 1, not be able to find an appropriate connecting path after receipt of a corresponding request of the switching equipment 1, the connection request is rejected by the switching equipment 2 in the form of the B-ISUP-return message IAR ("initial address rechecked"). In this case, the switching equipment 1 must select another adjacent switching equipment, which is able to act as "assigning exchange", i.e. that a re-routing is carried out.

Finally, it should be pointed out that, due to the reasons described in the beginning, the switching equipment 1, which becomes active as "non-assigning exchange", is not allowed to utilize the bits of information deposited in the shadow table of the storing means 16 for purposes of accepting a connection and for purposes of allocating a transmission channel. Exclusively the switching equipment, which is configured as "assigning exchange" for the corresponding connecting path, is allowed to decide about the allocation of a transmission channel and the occupancy of a bandwidth.

## Switching equipment

## Reference character list

- 5    1 - 3        switching equipment  
      4, 5 16     storing means  
      6            control means  
      7 - 15       connecting paths

## Patent claims

1. Switching equipment (1) for a communication network, whereby the switching equipment (1) is connected via at least one connecting path (9 - 15) to at least one
  - 5 other adjacent switching equipment (2, 3) of the communication network, and whereby the connecting paths (9, 15) connected to the switching equipment (1) are divided into first (9 - 11) and second (12 - 15) connecting paths, whereby, when a connection request is present, the switching equipment (1) is only authorized for the first connecting paths (9 - 11) for allocating a transmission channel for this connection
    - 10 request, whereas the adjacent switching equipment (2, 3) that is connected to the first switching equipment (1) via the corresponding second connecting path is authorized for allocating a corresponding transmission channel for the second connecting paths (12 - 15),
      - with first storing means (4) for purposes of storing bits of information about the free or
        - 15 occupied resources of the first connecting paths (9 - 11), and with control means (6) in order to, on the basis of the bits of information stored in the first storing means (4), detect a suitable first connecting path (9 - 11), which provides sufficient resources for the desired connection, when a connection request is present, characterized in that
          - 20 second storing means (16) are present for purposes of storing bits of information about the free or occupied resources of the second connecting paths (12 - 15), and that the control means (6) are fashioned such that they select an adjacent switching equipment (2, 3) on the basis of the bits of information stored in the second storing means (16) when a suitable first connecting path (9 - 11) could not be detected on the
            - 25 basis of the bits of information stored in the first storing means (4) given presence of a connection request, which switching equipment (2, 3) is connected to the switching equipment (1) via a second connecting path (12 - 15), which probably provides sufficient resources for the desired connection, and such that they transmit an inquiry message to the selected adjacent switching equipment (2, 3) for purposes of allocating
              - 30 a transmission channel for the desired connection.

2. Switching equipment according to claim 1,  
characterized in that,

the control means (6) are fashioned such that they, subsequent to the detection of a  
suitable first connecting path (9 - 11), transmit bits of information about the allocated

- 5 transmission channel for the desired connection and bits of information about the  
detected connecting path (9- 11) to the adjacent switching equipment (2, 3), which is  
connected to the first switching equipment (1) via the detected first connecting path (9  
- 11).

- 10 3. Switching equipment according to claim 2,  
characterized in that

the control means (6) are fashioned such that they, when a first connecting path (9- 11)  
with resources that are sufficient for the connection request could not be detected,  
transmit the inquiry message for allocating a transmission channel for the desired  
15 connection to the adjacent switching equipment (2, 3) in the form of a forward  
message without bits of information about the connecting path or the transmission  
channel.

- 20 4. Switching equipment according to one of the previous claims,  
characterized in that

- the control means (6) are fashioned such that they, subsequent to the inquiry message  
to the adjacent switching equipments (2, 3) selected by the control means (6) and  
subsequent to the allocation of a transmission channel by means of the adjacent  
switching equipment (2, 3), renew the bits of information, which are stored in the  
25 second storing means (6), on the basis of a confirmation message of the adjacent  
switching equipment (2, 3), whereby the confirmation message comprise bits of  
information about the transmission channel allocated by the adjacent switching  
equipment (2, 3), about the resources occupied for the desired connection and about  
the second connecting path (12 - 15) selected by means of the adjacent switching  
30 equipment (2, 3).

5. Switching equipment according to one of the previous claims,  
characterized in that  
the communication between the switching equipment (1) and the adjacent further  
switching equipments (2, 3) of the communication network ensues via B-ISUP  
5 signalization messages.
6. Switching equipment according to one of the previous claims,  
characterized in that  
third storing means (5) are provided for purposes of storing configuration data of the  
10 switching equipment (1), whereby the configuration data prescribe, regarding the  
switching equipment (1), which of the connecting paths connected to the switching  
equipment (1) are first connecting paths (9 - 11), for which the switching equipment  
(1) is authorized for allocating a transmission channel when a connection request is  
present, and which of the connecting paths are second connecting paths (12 - 15), for  
15 which the switching equipment (1) is not authorized, but for which a correspondingly  
adjacent switching equipment (2, 3) is authorized for allocating a transmission channel  
for the connection request.
7. Switching equipment according to claim 6,  
20 characterized in that  
the configuration data stored in the third storing means (5) prescribe to which adjacent  
switching equipment (2, 3) the switching equipment (1) is to detect a connecting path  
when a connection request is present.
- 25 8. Utilization of a switching equipment according to one of the previous claims in an  
ATM broadband communication network.

## Abstract

## Switching equipment

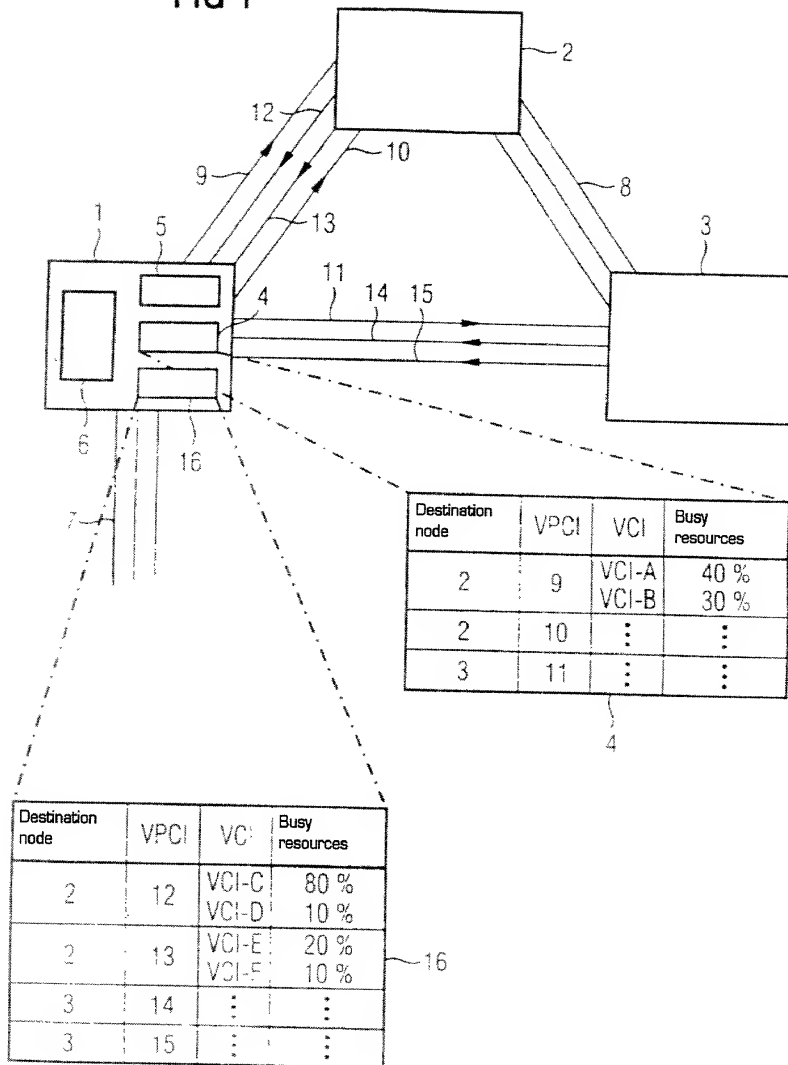
- 5 Switching equipment for a communication network, whereby the switching equipment (1) is connected via a plurality of connecting paths (9 - 15) to a plurality of adjacent switching equipments (2, 3). The switching equipment (1) is authorized for allocating a transmission channel and occupying corresponding bandwidth for a few of the connecting paths (9 - 11) when a connection request is present, whereas the
- 10 correspondingly adjacent switching equipment (2, 3) is authorized for allocating a transmission channel for the other connecting paths (12 - 15). The switching equipment (1) comprises storing means (16) that contains bits of information about the resources, which are allocated and occupied by the adjacent switching equipments (2, 3). When the switching equipment (1) is not able to select a suitable connecting path
- 15 (9 - 11), for which it is authorized for allocating a transmission channel, the switching equipment (1), on the basis of the bits of information deposited in the storing means (16), detects an adjacent switching equipment (2, 3) that is highly likely to be able to allocate sufficient resources for the present connection request.

20 (Figure 1)



1/2

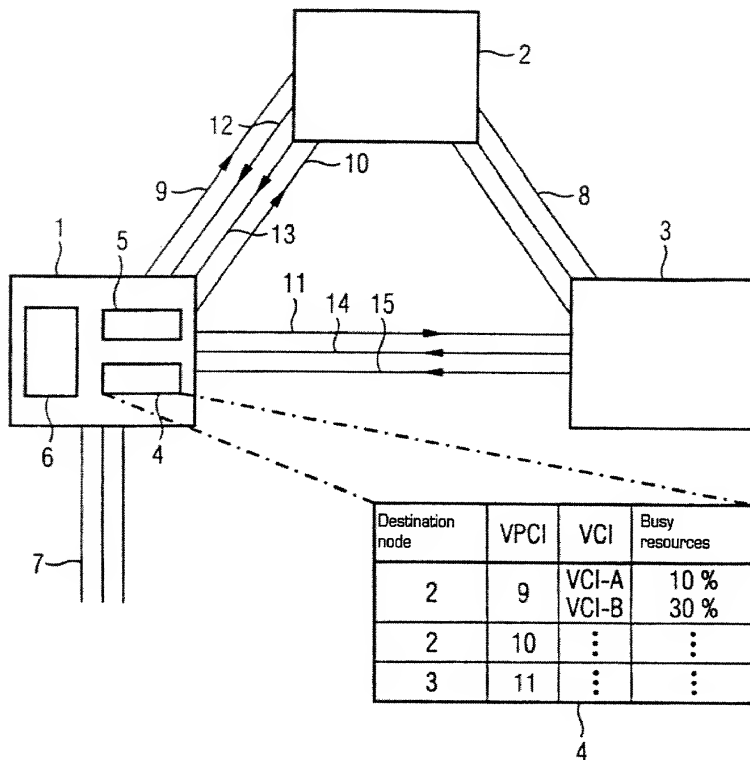
FIG 1



2/2

(Prior Art)

FIG 2



09/623638

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

CHANGE OF ADDRESS OF APPLICANTS' REPRESENTATIVE

APPLICANT(S): ARNO BRILL  
ATTORNEY DOCKET NO.: P00,1122  
INTERNATIONAL APPLICATION NO: PCT/DE99/00673  
INTERNATIONAL FILING DATE: 11 MARCH 1999  
INVENTION: ATM SWITCHING DEVICE WITH FIRST AND  
SECOND CONNECTION PATHS

Assistant Commissioner for Patents,  
Washington, D.C. 20231

Sir:

Members of the firm of Hill & Simpson designated on the original Power of Attorney have merged into the firm of Schiff Hardin & Waite. All future correspondence for the above-referenced application therefore should be sent to the following address:

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Date: September 6, 2000

# Declaration and Power of Attorney For Patent Application

## Erklärung Für Patentanmeldungen Mit Vollmacht

### German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt.

As a below named inventor, I hereby declare that

dass mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

My residence, post office address and citizenship are as stated below next to my name,

dass ich, nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Vermittlungseinrichtung \_\_\_\_\_

\_\_\_\_\_

deren Beschreibung

the specification of which

(zutreffendes ankreuzen)

(check one)

☒ hier beigefügt ist

☐ is attached hereto.

☐ am \_\_\_\_\_ als

☐ was filed on \_\_\_\_\_ as

PCT internationale Anmeldung

PCT international application

PCT Anmeldungsnummer \_\_\_\_\_

PCT Application No \_\_\_\_\_

eingereicht wurde und am \_\_\_\_\_

and was amended on \_\_\_\_\_

abgeändert wurde (falls tatsächlich abgeändert)

(if applicable)

Ich bestätige hiermit, dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) von Wichtigkeit sind, an.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a)

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

# German Language Declaration

Prior foreign applications  
Priorität beansprucht

Priority Claimed

198 10 559.2 Germany 11. März. 1998  
(Number) (Country) (Day Month Year Filed)  
(Nummer) (Land) (Tag Monat Jahr eingereicht)

☒ ☐  
Yes No  
Ja Nein

                                                                
(Number) (Country) (Day Month Year Filed)  
(Nummer) (Land) (Tag Monat Jahr eingereicht)

☐ ☐  
Yes No  
Ja Nein

                                                                
(Number) (Country) (Day Month Year Filed)  
(Nummer) (Land) (Tag Monat Jahr eingereicht)

☐ ☐  
Yes No  
Ja Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §122, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application

(Application Serial No.)  
(Anmeldeseriennummer)

(Filing Date)  
(Anmeldedatum)

(Status)  
(patentiert, anhängig,  
aufgegeben)

(Status)  
(patented, pending,  
abandoned)

(Application Serial No.)  
(Anmeldeseriennummer)

(Filing Date)  
(Anmeldedatum)

(Status)  
(patentiert, anhängig,  
aufgeben)

(Status)  
(patented, pending,  
abandoned)

Ich erkläre hiermit, dass alle von mir in der vorliegenden Erklärung gemachten Angaben nach meinem besten Wissen und Gewissen der vollen Wahrheit entsprechen, und dass ich diese eidesstattliche Erklärung in Kenntnis dessen abgebe, dass wissentlich und vorsätzlich falsche Angaben gemäss Paragraph 1001, Absatz 18 der Zivilprozessordnung der Vereinigten Staaten von Amerika mit Geldstrafe belegt und/oder Gefängnis bestraft werden können, und dass derartig wissentlich und vorsätzlich falsche Angaben die Gültigkeit der vorliegenden Patentanmeldung oder eines darauf erteilten Patentes gefährden können.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such wilful false statements may jeopardize the validity of the application or any patent issued thereon.

# German Language Declaration

VERTRETUNGSVOLLMACHT: Als benannter Erfinder beauftrage ich hiermit den nachstehend benannten Patentanwalt (oder die nachstehend benannten Patentanwälte) und/oder Patent-Agenten mit der Verfolgung der vorliegenden Patentanmeldung sowie mit der Abwicklung aller damit verbundenen Geschäfte vor dem Patent- und Warenzeichenamt: (Name und Registrationsnummer anführen)

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith (list name and registration number)

And I hereby appoint  
Messrs. John D. Simpson (Registration No. 19,842), Lewis T. Steadman (17,074), William C. Stueber (16,453), P. Phillips Connor (19,259), Dennis A. Gross (24,410), Marvin Moody (16,549), Steven H. Noll (28,982), Brett A. Valiquet (27,841), Thomas I. Ross (29,275), Kevin W. Guynn (29,927), Edward A. Lehmann (22,312), James D. Hobart (24,149), Robert M. Barrett (30,142), James Van Santen (16,584), J. Arthur Gross (13,615), Richard J. Schwarz (13,472) and Melvin A. Robinson (31,870), David R. Metzger (32,919), John R. Garrett (27,888) all members of the firm of Hill, Steadman & Simpson, A Professional Corporation.

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(Name und Telefonnummer)

Direct Telephone Calls to. (name and telephone number)

312/876-0200  
Ext. \_\_\_\_\_

Postanschrift

Send Correspondence to:

**HILL, STEADMAN & SIMPSON**  
A Professional Corporation  
85th Floor Sears Tower, Chicago, Illinois 60606

Voller Name des einzigen oder ursprünglichen Erfinders:		Full name of sole or first inventor.	
BRILL, Arno			
Unterschrift des Erfinders	Datum	Inventor's signature	Date
<i>Arno Brill</i>	20.03.1999		
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Staatsangehörigkeit		Citizenship	
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D-81377 München			
Bundesrepublik Deutschland			
Voller Name des zweiten Miterfinders (falls zutreffend):		Full name of second joint inventor, if any:	
Unterschrift des Erfinders	Datum	Second Inventor's signature	Date
Wohnsitz		Residence	
Staatsangehörigkeit		Citizenship	
Postanschrift		Post Office Address	

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).